

4/pats

JC20 Rec'd PCT/PTO 06 JUL 2005

Attorney Docket No. 38195.65

FOOTWEAR

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

The present invention relates to footwear that absorbs impacts on a foot during walking.

2. Description of the Related Art

10 An exemplary conventional shoe includes a leather upper portion 501 and a shoe sole 502 that is separate from the leather upper portion 501. In the shoe sole 502, a shock absorber 503 such as a sponge is provided, as shown in Fig. 6, (see Japanese Patent Laid-Open Publication No. 2002-85108, and
15 Japanese Utility-Model Laid-Open Publications Nos. Hei 6-7506 and Hei 6-77506). In this structure, the shock absorber 503 within the shoe sole absorbs an impact on a foot when the foot comes into contact with the ground during walking, thereby reducing fatigue of the foot.

20 However, because the shoe includes two parts, i.e., the shoe sole 502 including an outer sole, a midsole, and the like, and the leather upper portion 501 bonded to the shoe sole 502 to enclose the instep of the foot, the shoe sole 502 cannot easily conform to the movement of the foot during walking.

25 Therefore, it is difficult for the aforementioned structure to

efficiently absorb an impact on the foot.

More specifically, during walking, the shoe changes shape because of the movement of the foot. Thus, the shoe sole 502 cannot easily conform to the movement of the foot while
5 fitting the sole of the foot. Therefore, the shock absorber 503 provided within the shoe sole 502 cannot sufficiently absorb an impact on the foot.

Especially, in shoes with heels, such as a pair of pumps, the center of gravity moves toward a toe. Thus, it is likely
10 that the toe receives a greater impact. Moreover, since the movement of the toe is greater than that of the other portion, the fit is insufficient on the toe and an impact on the toe is not sufficiently absorbed.

15 SUMMARY OF THE INVENTION

To overcome the problems described above, preferred embodiments of the present invention provide footwear that easily conforms to movement of a toe during walking and that sufficiently absorbs an impact on the toe.

20 Footwear according to a preferred embodiment of the present invention includes an insole provided in a front portion of a surface of an outer sole of the footwear, the surface being in contact with a sole of a foot. The insole is provided with a shock absorber that is in contact with a front
25 portion of the sole of the foot to absorb an impact.

According to the structure described above, the shock absorber is stably located at a toe because the shock absorber is provided in the insole.

Footwear according to another preferred embodiment of the present invention includes an upper leather member and a shoe sole bonded at its upper portion to the upper leather member, the upper leather member being configured to enclose an instep of the foot and having a bottom opening rim closely resembling an outer shape of the sole of the foot, an insole bonded to a front portion of the bottom opening rim of the upper leather member so that a front portion of the upper leather member is configured in the shape of a bag to enclose a toe, and the insole is provided with a shock absorber.

According to this structure, the insole is bonded to the front portion of the bottom opening rim of the upper leather such that the front portion of the upper leather member is configured in a shape of a bag to enclose the toe. Therefore, the ability of the footwear to conform to the movement of the toe during walking is improved. Moreover, the shock absorber is stably located at the toe because the shock absorber is provided insole.

In the footwear according to the preferred embodiments of the present invention, the shock absorber preferably includes a gel.

By making the shock absorber of a gel, deterioration of

the shock absorber in which the shock absorber cannot recover from a compressed state because of long-term compression is greatly reduced, unlike a shock absorber made of a sponge. Thus, deterioration of the insole caused by deterioration of the shock absorber because of long-term use is prevented, such that a large change of the width of the footwear cannot occur. In addition, a gel does not suffer hydrolysis caused by absorbed moisture, such as sweat, unlike a sponge, and therefore degradation of a shock-absorbing property caused by hydrolysis is prevented.

In the footwear according to the preferred embodiments of the present invention, the shock absorber preferably has an Asker F hardness in the range of about 30 to about 90. This ensures a good fit between the toe and the footwear and sufficient absorption of an impact on the toe. When the Asker F hardness is less than about 30, the shock absorber is too soft and cannot maintain the shape of the insole. This permits excessive movement of the toe in the footwear, and degrades the fit of the footwear. On the other hand, when the Asker F hardness is greater than about 90, the shock absorber is too hard and prevents sufficient shock absorption by the insole.

In the footwear according to the preferred embodiments of the present invention, the shock absorber preferably has an Asker F hardness in the range of about 30 to about 90 and an Asker C hardness in the range of about 10 to about 25.

In this case, the shock absorber feels relatively hard when being compressed over an area approximately the same size as a palm. However, the shock absorber feels relatively soft when being compressed over an area approximately the size of a
5 finger. Therefore, the shock absorber firmly supports the entire toe and softly supports protruding portions of the toe, by changing its shape in accordance with the shapes of the protruding portions. Thus, it is possible to provide an improved fit and to sufficiently absorb an impact, especially
10 on the protruding portions of the toe.

In other words, when the Asker F hardness is in the range of about 30 to about 90, the fit between the toe and the footwear is outstanding, and the shock absorber sufficiently absorbs an impact on the toe like.

15 When the Asker C hardness is in the range of about 10 to about 25, the shock absorber appropriately changes its shape in accordance with the protruding portions of the toe. Therefore, the fit and the shock absorbing property is further improved. When the Asker C hardness is less than about 10, the
20 shock absorber is too soft and permits the protruding portions of the wearer's toe to compress the shock absorber too much. This degrades the fit of the footwear. On the other hand, when the Asker C hardness is greater than about 25, the change of the shape of the shock absorber in accordance with the
25 protruding portions of the wearer's toe is not sufficient,

although sufficient shock absorption is achieved.

In the footwear according to the preferred embodiments of the present invention, each of the insole and the shock absorber is preferably configured to have a length and a width
5 corresponding to those of a region of the sole of the foot from the tip of the toe to a front end of an arch.

This makes it possible to absorb an impact on the entire front portion of the sole of the foot.

According to the preferred embodiments of the present
10 invention, the shock absorber is stably located at the toe during walking. Thus, it is possible to absorb a large impact on the toe and greatly reduce fatigue, pains, and other stresses of the foot.

With the shock absorber being made of a gel, the fit when
15 a wearer wears the footwear for the first time is permanently maintained, and it is possible to absorb an impact on the toe permanently.

With the shock absorber having an Asker F hardness in the range of about 30 to about 90, the fit between the toe and the
20 footwear is outstanding, and an impact on the toe is sufficiently absorbed.

With the shock absorber having an Asker F hardness in the range of about 30 to about 90 and an Asker C hardness in the range of about 10 to about 25, it is possible to firmly
25 support the entire toe. Moreover, it is possible to softly

v
support the protruding portions of the toe by changing the shape of the shock absorber in accordance with the protruding portions of the toe. Therefore, the fit is further improved and an impact on the protruding portions of the toe is
5 sufficiently absorbed.

With each of the insole and the shock absorber being configured to have a length and a width corresponding to those of a region of the sole of the foot from the tip of the toe to a front end of an arch, the shock absorber is more stably
10 located at the toe during walking. Therefore, it is possible to absorb an impact on the front portion of the sole of the foot and greatly reduce fatigue, pains, or the stresses of the foot.

Other features, elements, steps, characteristics and
15 advantages of the present invention will become more apparent from the following detailed description of preferred embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Fig. 1 is a cross-sectional view of a shoe according to a preferred embodiment of the present invention;

Fig. 2 is an exploded perspective view of the shoe according to a preferred embodiment of the present invention;

Fig. 3 is a plan view showing a state in which an insole
25 is stitched to a lining portion of the front portion of an

upper leather member by French seam;

Fig. 4 is a perspective view showing an exemplary structure of the insole;

Fig. 5 is a perspective view of another exemplary structure of the insole; and

Fig. 6 is a cross-sectional view of a conventional shoe having a shock-absorbing property.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Preferred embodiments of the present invention are now described with reference to the drawings.

As shown in Figs. 1 and 2, a shoe according to a preferred embodiment of the present invention includes an upper leather member 1 shaped to enclose the instep of a foot and a shoe sole 2 bonded at an upper portion thereof to the upper leather member 1.

The shoe sole 2 includes a plate-like outer sole 21 having an outer shape that closely resembles the outer shape of the sole of the foot, a heel 22 in the form of a block provided at the heel portion of the rear portion of the outer sole 21, and a half midsole 23 in the form of a sheet bonded to the rear portion of the upper surface of the outer sole 21. The heel 22 is provided separately from the outer sole 21 and is bonded to the outer sole 21 with glue, nails, and other suitable bonding material. However, the heel 22 may be

integrally formed with the outer sole 21. The outer sole 21 and the heel 22 are preferably made of a synthetic resin, wood, or other suitable material. The half midsole 23 extends from the heel of the foot to the front end of the arch, and is bonded to the upper surface of the outer sole 21 by adhesion or sewing with a bottom opening rim 12 of the upper leather member 1 disposed between the half midsole 23 and the upper surface of the outer sole 21. The half midsole 23 is preferably made of cloth, leather, or other suitable material.

10 The upper leather member 1 is formed by shaping natural leather or synthetic leather to conform to the shape of the instep of a foot. The upper leather member 1 includes an upper opening rim 11 to permit a foot to be inserted into the shoe in its upper portion and a bottom opening rim 12 that closely resembles the outer shape of the sole of the foot in its lower portion (see Fig. 2). In the front portion of the bottom opening rim 12 of the upper leather member 1, an insole 3 in the form of a sheet is stitched by French seam. The front portion of the upper leather member 1 is configured in the shape of a bag so as to enclose a toe. More specifically, as shown in Fig. 3, the upper leather member 1 includes an outer material portion 13 and a lining portion 14. The insole 3 is stitched at its outer peripheral edge to the outer peripheral edge of the lining portion 14. Thus, the insole 3 is in contact with a region of the sole of the foot from the toe to

the front end of the arch.

As a shoemaking method in which the front portion of the upper leather member 1 is stitched by French seam, a Bolognese method is known, for example.

5 The upper leather member 1 is bonded to the upper portion of the outer sole 21 with the bottom opening rim 12 folded inward. More specifically, the rear portion of the bottom opening rim 12 of the upper leather member 1 is glued or sewed to the outer sole 21 with an inwardly folded bonding margin
10 being sandwiched between the outer peripheral edge of the outer sole 21 and the outer peripheral edge of the half midsole 23. The front portion of the upper leather member 1 is glued or sewed to the outer sole 21 via bonding margin formed by folding the front portion inwardly, together with the lower
15 surface of the insole 3. Thus, the insole is provided on the front portion of the surface of the outer sole of the footwear, the surface being in contact with the sole of the foot.

As shown in Fig. 4, the insole 3 stitched to the front portion of the upper leather member 1 by French seam is formed
20 by sandwiching a gel 31 between two fabric members 32 and 33 made of a non-woven fabric or other suitable material, applying adhesive or other bonding material to the peripheral portions of the two fabric members 32 and 33, and bonding them to each other. The two fabric members 32 and 33 have a length
25 and width corresponding to at least those of the region of the

sole of the foot from the tip of the toe to the front end of the arch. The gel 31 also has a length and a width corresponding to at least those of the region of the sole of the foot from the tip of the toe to the front end of the arch.

5 In other words, the two non-woven fabric members 32 and 33 and the gel 31 have similar shapes, and the two non-woven fabric members 32 and 33 are larger than the gel 31 to provide an adhesion margin or sewing margin in order to sandwich the gel 31 therebetween. The insole 3 is provided with a shock
10 absorber 30 defined by the gel 31 and has a thickness of approximately 5 mm, for example. Examples of the gel 31 include a member formed by a gel material sandwiched between two films (for example, one known as "U-NBC-45" manufactured by IIDA Industry Co., Ltd.).

15 A non-woven fabric used for the fabric members 32 and 33 is fabricated by a spunbond method, a needle punch method, a melt-blow method, and other suitable method. From a viewpoint of the strength of the fabric, it is preferable to use a non-woven fabric fabricated by the melt-blow method.

20 Moreover, it is preferable that the non-woven fabric member 32 be formed from a fabric that does not weaken the effect of the gel 31 and maintains contact with the sole of the foot.

As the shock absorber 30 in the insole 3, various
25 materials having shock-absorbing properties, other than the

gel 31, such as a sponge and an elastomer can be used.

In addition, as shown in Fig. 5, it is preferable that the insole 3 includes stretchable films 34 that sandwich the gel 31 therebetween. The film 34 has a planar shape and a size that is approximately the same as that of the gel 31. The film 34 preferably maintains contact with the sole of the foot provided by the effect of the gel 31, and for example, is made of polyester urethane.

On the other hand, as a result of repeated compression caused by application of the weight equal to or greater than the wearer's weight during walking, the shock absorber 30 may be deteriorated and may not recover from a compressed state. In this case, the insole 3 is similarly deteriorated. As a result, the width of the toe (width of the footwear) increases. Moreover, deterioration of the insole 3 substantially degrades its shock-absorbing properties. Therefore, once the insole 3 is deteriorated, the fit on the toe is deteriorated, and thus, the shock-absorbing properties are dramatically degraded. From this perspective, the shock absorber 30 made of the gel 31 is preferable to a sponge or an elastomer.

That is, by the gel 31 for the shock absorber 30, deterioration in which the shock absorber 30 cannot recover from a compressed state because of long-term compression is greatly reduced, unlike a shock absorber defined by a sponge. Therefore, the gel 31 is superior to a sponge in terms of

recoverability (restoration property) against compression.
Thus, the use of the gel 31 prevents deterioration of the
insole 3 caused by deterioration of the shock absorber 30 due
to long-term use. Also, the width of the footwear does not
5 substantially change over time. Moreover, unlike a sponge, the
gel 31 is preferable because it does not suffer hydrolysis
caused by absorbed moisture such as sweat, and therefore,
degradation of the shock-absorbing properties caused by
hydrolysis of the gel 31 does not occur. As a result, the fit
10 on the toe when the wearer wears the shoe for the first time
is permanently maintained, and the shock-absorbing properties
are ensured.

The gel 31 defining the shock absorber 30 preferably has
an Asker F hardness (hardness measured when being pressed by
15 an area approximately the same as a palm) in the range of
about 30 to about 90, and an Asker C hardness in the range of
about 10 to 25. The Asker F hardness is a hardness measured
when an object is compressed over a wide area approximately
the same size as a palm. The Asker C hardness is a hardness
20 measured when the object is compressed over a narrow area
approximately the same size as a finger. Both of the Asker F
hardness and the Asker C hardness are used as a standard of
hardness for a rubber elastic material and other similar
materials.

25 Thus, the gel 31 feels relatively hard when being

compressed over an area approximately the size as a palm. On the other hand, the gel 31 feels relatively soft when being compressed over a small area approximately the size as a finger. Therefore, the gel 31 firmly supports the entire toe, and softly supports protruding portions of the toe by changing its shape in accordance with the shapes of those protruding portions. Thus, the gel 31 maintains an outstanding fit and sufficiently provides shock absorbing properties, especially for the projecting portions of the toe.

When the Asker F hardness is within the aforementioned range, an outstanding fit between the toe and the shoe maintained and an impact on the toe is sufficiently absorbed. In other words, when the Asker F hardness is less than the aforementioned range, the shock absorber 30 is too soft and degrades the shape-maintaining property of the insole 3. This allows easy movement of the toe in the shoe and degrades the fit. On the other hand, when the Asker F hardness is greater than the aforementioned range, the shock absorber 30 is hard and prevents sufficient shock absorption by the insole 3.

Moreover, when the Asker C hardness is within the aforementioned range, the shock absorber 30 changes its shape appropriately in accordance with the protruding portions of the toe. Therefore, the fit and the shock-absorbing property are further improved. When the Asker C hardness is less than the aforementioned range, the shock absorber 30 is too soft

and may cause the protruding portions to excessively compress the insole. This may lead to a deteriorated fit. On the other hand, when the Asker C hardness is greater than the aforementioned range, while an impact is sufficiently absorbed, the change of the shape of the gel 31 in accordance with the protruding portions of the toe is not sufficient. This prevents further improvements in the fit.

Examples of the material for the gel 31 include silicon resins, polyurethane resins, acrylamide gels, thermoplastic elastomers (such as styrene block copolymer; SBS, styrene-isoprene-styrene block copolymer; SIS), epoxy resins (containing plasticizer), starch-based gels (copolymer of acrylonitrile and acrylic acid). Considering abrasion resistance, tear strength, elongation, balance between viscosity and elasticity, and cost, polyurethane resins are preferable.

A polyurethane resin is formed from polyol, isocyanate, and other suitable resin.

Examples of the polyol include polyether-type polyols (polyoxypropylene glycol; PPG, polyethylene glycol; PEG, and polytetramethylene ether glycol; PTMEG), polyester-type polyols (adipate-type polyols, polycaprolactone, aromatic-type polyols, and polycarbonate-type polyols), polyolefin-type polyols, acryl-type polyols. Considering the cost and water resistance, polyether-type polyols are preferable.

Examples of the isocyanate include TDI (tolylene diisocyanate), MDI (diphenylmethane diisocyanate), HDI (hexamethylene diisocyanate), NDI (naphthalene diisocyanate), IPDI (isophorone diisocyanate), and denatured isocyanate of those materials. Considering the cost, ease of handling, and reaction stability, the use of tolylene diisocyanate is preferable.

A ratio of the polyol and the isocyanate determines the Asker F hardness. For example, in the case where polyoxypropylene glycol (PPG) having molecular weights of 2000 and 10000 is used as the polyol and tolylene diisocyanate based denatured isocyanate is used as the isocyanate, the following blending amounts are used.

According to a preferred embodiment of the present invention, the polyol contains polyoxypropylene glycol (PPG) having a molecular weight of 2000 and PPG having a molecular weight of 10000 that are blended at a weight ratio of 1:1. Thus, the amount of each of PPG having a molecular weight of 2000 and PPG having a molecular weight of 10000 is about 10 to about 20 parts by weight, and more preferably in the range of about 12.5 parts by weight to about 15 parts by weight. When the polyol contains PPG having a molecular weight of 1000 in an amount of about 20 parts by weight or less, the Asker F hardness exceeds about 90 and sufficient shock absorption cannot be achieved. When the polyol contains that PPG in an

amount of about 40 parts by weight or more, the Asker F hardness is less than about 30. Thus, the shock absorber is too soft and the shape-maintaining property of the insole is degraded.

5 When tolylene diisocyanate based denatured isocyanate (NCO% = 3%) is used as isocyanate, the blending ratio thereof is in a range of about 35 to about 50 parts by weight, and more preferably, in the range of about 40 parts by weight to about 45 parts by weight.

10 When the blending ratio of the isocyanate is about 50 parts by weight or more, the Asker F hardness exceeds about 90 and sufficient shock absorption cannot be achieved. When the blending ratio is about 35 parts by weight or less, the Asker F hardness is less than about 30. Thus, the shock absorber is
15 too soft and the shape-keeping property of the insole is degraded.

Polyurethane can be obtained by reacting polyol with isocyanate in the presence of a catalyst. Examples of the catalyst include amine type compounds and metal (nickel, tin,
20 zinc, cadmium, magnesium, and mercury) compounds. Considering flexibility and control of the reaction, the use of metal compounds (e.g., a tin compound) is preferable.

It is preferable that the amount of the catalyst used be about 0.1 to about 1 parts by weight, provided that the amount
25 of polyurethane (polyol + isocyanate) is 100. This provides a

hardening ability and durability within appropriate ranges.

The polyurethane resin may contain a plasticizer. Examples of the plasticizer include aliphatic compounds, alicyclic compounds, and aromatic compounds (dibutyl phthalate, diheptyl phthalate, dioctyl phthalate, diisodecyl phthalate, ditridecyl phthalate, butylbenzyl phthalate, and butylphthalyl butylglycolate). Considering compatibility, the use of aromatic compounds is preferable. Particularly, the use of dibutyl phthalate is more preferable.

10 However, a polyurethane resin containing no plasticizer is the most preferable. This is because the plasticizer migrates to the non-woven fabric members 32 and 33 of the insole 3 and degrades the function of the insole 3. When using a plasticizer, the insole 3 is covered with a stretchable film
15 that prevents permeation of the plasticizer.

The used amount of the plasticizer is preferably about 0 to about 50 parts by weight, with respect to the amount of polyurethane (polyol + isocyanate) as 100. This makes it possible to set the Asker hardness within an appropriate range.

20 Polyurethane resin may contain colorants, age resistors (antioxidants, ultraviolet absorber, light stabilizer, hydrolysis inhibitor), antifoamers, flame retardants, and other suitable additives.

The shoe having the aforementioned structure can be
25 fabricated in a similar manner to the conventional shoemaking

method, and therefore, only a brief description is made. First, the upper leather member 1 is fabricated as follows. Leather as the material for the upper leather member 1 is cut out in accordance with a predetermined pattern paper. The cut leather is shaped to fit on a wooden pattern having a shape of a foot. Then, the insole 3 provided with a shock absorber 30, which has been prepared in advance, is stitched to the lining portion 14 in the front portion of the bottom opening rim 12 by French seam in such a manner that the front portion of the bottom opening rim 12 forms a bag. Thus, fabrication of the upper leather member 1 is finished. Next, a bonding margin is formed by folding the bottom opening rim 12 of the upper leather member 1 inward. Then, the upper leather member 1 is placed on the upper portion of the outer sole 21 including the heel 22, which has been fabricated in advance by molding. The rear portion of the upper leather member 1 is glued, sewed, or otherwise connected to the outer sole 21 with the bonding margin interposed between the outer peripheral edge of the outer sole 21 and the outer peripheral edge of the half midsole 23. The front portion of the upper leather member 1 is glued or sewed to the outer sole 21 at its bonding margin formed by folding the outer material portion 13 of the upper leather member 1, together with the lower surface of the insole 3. In this manner, the aforementioned shoe is completed.

As described above, in the shoe according to the

preferred embodiment described above, the insole 3 is bonded to the front portion of the bottom opening rim 12 of the upper leather member 1, and the front portion of the upper leather member 1 is configured in the shape of a bag so as to enclose a toe. Thus, the ability of the shoe to conform to the movement of the toe during walking is greatly improved. Moreover, the shock absorber 30 having a length and width corresponding to those of the region of the sole of the foot from the tip of the toe to the front end of the arch is provided in the insole 3. Thus, the shock absorber 30 is stably located with respect to the toe, for example, the region from the tip of the toe of the sole of the wearer's foot to the front end of the arch. Therefore, it is possible to absorb a large impact on the toe and greatly reduce fatigue or pains of the foot.

Moreover, by forming the shock absorber 30 using the gel 31, deterioration of the shock absorber 30, in which the shock absorber 30 cannot recover from a compressed state because of long-term compression, does not occur, unlike a shock absorber defined by a sponge. Thus, deterioration of the insole 3 caused by the deterioration of the shock absorber 30 due to long-term use is prevented, such that the width of the footwear is not substantially changed. In addition, unlike a sponge, the gel 31 does not suffer hydrolysis caused by absorbed moisture such as sweat, and therefore, degradation of

a shock-absorbing property caused by hydrolysis does not occur. Therefore, the fit when a wearer wears the shoes for the first time is maintained permanently, and an impact on the wearer's toe is absorbed permanently.

5 In addition, by using the fabric member 32 made of a non-woven fabric or other suitable material, the gel 31 does not come into direct contact with a sole of a foot. Moreover, by sandwiching a film 34 between the gel 31 and the non-woven fabric member 32, permeation of the gel 31 through the fabric
10 member 32 is prevented. Thus, where the gel 31 is permeated, it is possible to prevent a wearer from feeling discomfort, for example, feeling that the sole of the foot is sticky because of the gel 31.

 Furthermore, by selecting the material for the gel 31 as
15 the shock absorber 30 so as to achieve the Asker F hardness in the range of about 30 to about 90 and the Asker C hardness in the range of about 10 to about 25, the gel 31 firmly supports the entire toe, and softly support the protruding portions of the toe, by changing its shape in accordance with those
20 protruding portions. Thus, the fit is improved, and shock absorption is sufficiently provided, especially for the protruding portions of the toe, such as fingers.

 Next, a compression and recovery test was performed for a gel and a sponge. The test is generally described below.

25 <Examples>

(1) Gel (having a thickness of 12 mm by stacking 3-mm-thick sheets of "U-NBC-45" manufactured by IIDA Industry Co., Ltd.)

(2) Sponge (having a thickness of 12 mm by stacking 2-mm-thick sheets of "H-32" manufactured by Rogers Inoac Corporation)

<Test method>

For each sample, compression (about 5 hours) and release (about 1 hour) were repeated eight times. Then, after each sample was left as it was for 30 minutes, 24 hours, and 36 hours, a ratio of thickness distortion (compression set (%)) was measured (see Table 1). The compression was performed to reduce the thickness of the sample to $\frac{1}{4}$ (25%) of the original thickness.

【Table 1】

Time(h) Compression set (%)	0.5(h)	24(h)	36(h)
Gel	8.0(%)	4.3(%)	2.7(%)
Sponge	30.0(%)	21.0(%)	11.5(%)

<Evaluation>

As is apparent from the above results, for both the gel and the sponge, compression set becomes smaller with the time. However, it was found that compression set of the gel was

smaller than that of the sponge from the beginning of the release and therefore deterioration of the gel was less than that of the sponge.

Values of hardness of the gel ("U-NBC-45" manufactured by IIDA Industry) and the sponge ("H-32" manufactured by Rogers Inoac Corporation) that have a thickness of 20 mm and were used in the above samples are as follows (see Table 2). The values of hardness in Table 2 were measured by an Asker F hardness tester and an Asker C hardness tester.

10

【Table 2】

	Asker F hardness	Asker C hardness
Gel	85	17
Sponge	78	40

The above gel and the above sponge satisfy the condition in which the Asker F hardness is in a range of about 30 to about 90. Therefore, both the above gel and the above sponge maintain the fit between a wearer's toe and a shoe and sufficiently absorb an impact on the toe.

On the other hand, the above gel also satisfies the condition in which the Asker C hardness is in a range of about 10 to about 25. Therefore, the gel firmly supports the entire toe, and softly supports protruding portions of the toe, by changing its shape in accordance with the protruding portions.

Thus, the gel better maintains the fit and sufficiently absorbs an impact especially on the protruding portions of the toe.

In the above-described preferred embodiment, a pair of pumps provided with heels is described as an example. However, the present invention may be applied to a pair of boots or shoes with no heels. Moreover, the present invention may be applied to any ladies' shoe and any men's shoe. In addition, the present invention may be applied not only to formal shoes but also to various sports shoes, such as jogging shoes. Furthermore, the present invention may be applied to footwear such as sandals or slippers. The materials for the upper leather member 1 and the outer sole 2 are not limited to the materials described above. Various materials can be used.

While the present invention has been described with respect to preferred embodiments, it will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than those specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the invention which fall within the true spirit and scope of the invention.